

## Recombinant collagen scaffolds as substrates for human neural stem/progenitor cells.

**Journal:** J Biomed Mater Res A

**Publication Year:** 2018

**Authors:** Richard A Que, Janahan Arulmoli, Nancy A Da Silva, Lisa A Flanagan, Szu-Wen Wang

**PubMed link:** 29341434

**Funding Grants:** Molecular basis of plasma membrane characteristics reflecting stem cell fate potential

### Public Summary:

Adhesion to the microenvironment profoundly affects stem cell functions, including cell division and the formation of mature cells. We investigated the effects of two peptide sequences from proteins of the stem cell microenvironment, collagen I and laminin, on human neural stem/progenitor cells (hNSPCs). To test the specificity of these peptides, they were placed within the context of recombinant collagen III engineered to lack the usual binding sites. hNSPCs adhered to substrates that presented the collagen I peptide as the sole binding site, but not to those containing the laminin peptide. Binding to the collagen I peptide was disrupted by blocking two particular receptors on the cell surface that bind cells to the microenvironment, beta1 and alpha1 integrin. These results indicate that hNSPCs primarily interact with the collagen peptide through the alpha1beta1 integrin pair on the cell surface. These collagen peptide substrates supported the formation of neurons and astrocytes from hNSPCs. Our findings show that hNSPCs can bind to the collagen I peptide, providing motivation to develop collagen I peptide substrates as stem cell delivery scaffolds.

### Scientific Abstract:

Adhesion to the microenvironment profoundly affects stem cell functions, including proliferation and differentiation, and understanding the interaction of stem cells with the microenvironment is important for controlling their behavior. In this study, we investigated the effects of the integrin binding epitopes GFOGER and IKVAV (natively present in collagen I and laminin, respectively) on human neural stem/progenitor cells (hNSPCs). To test the specificity of these epitopes, GFOGER or IKVAV were placed within the context of recombinant triple-helical collagen III engineered to be devoid of native integrin binding sites. hNSPCs adhered to collagen that presented GFOGER as the sole integrin-binding site, but not to IKVAV-containing collagen. For the GFOGER-containing collagens, antibodies against the beta1 integrin subunit prevented cellular adhesion, antibodies against the alpha1 subunit reduced cell adhesion, and antibodies against alpha2 or alpha3 subunits had no significant effect. These results indicate that hNSPCs primarily interact with GFOGER through the alpha1beta1 integrin heterodimer. These GFOGER-presenting collagen variants also supported differentiation of hNSPCs into neurons and astrocytes. Our findings show, for the first time, that hNSPCs can bind to the GFOGER sequence, and they provide motivation to develop hydrogels formed from recombinant collagen variants as a cell delivery scaffold. (c) 2018 Wiley Periodicals, Inc. J Biomed Mater Res Part A: 106A: 1363-1372, 2018.

**Source URL:** <https://www.cirm.ca.gov/about-cirm/publications/recombinant-collagen-scaffolds-substrates-human-neural-stemprogenitor-cells>